

Managing weeds for the long-term in processing vegetable crops

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Weed management in processing vegetable crops is a continuing challenge. Weeds in these crops can lower crop yields, reduce harvester efficiency, and increase input costs. In addition, stems, buds, and seeds of weeds can become costly and sometimes dangerous contaminants of processing vegetables (Fig. 1).



Figure 1. Weed contaminants found in processing snap beans. Among the contaminants were seeds of *Ipomea* spp seeds which contain D-lysergic acid amide (LSD).

In several important processing vegetables in NY, the number of registered herbicides is small, and the efficacy of these products on important weeds is limited. For example, beet growers have limited options for control of several broadleaf weeds including pigweeds (redroot and Powell amaranth) and mustards (Table 1). Similarly, carrot growers are faced with several broadleaf weeds that are difficult to control with available herbicides (Tables 2). In some cases, repeated use of these herbicides (e.g. lorox) has led to development of resistance that creates further challenges for growers.

Given limitations of herbicides in many processing vegetable crops, it is worthwhile considering cultural, biological and mechanical strategies to prevent buildup of problematic species before they get a foothold.

Prevention of seed production. Many weed species that are problematic in processing vegetables have seeds that last many years in the soil. An important goal in any long term approach to weed management is prevention of seed production among such species.

Table 1. Efficacy of beet herbicides on selected annual broadleaf weeds

Product	Lambsquarters	Purslane	Ragweed	Pigweed	Smartweed	Galinsoga	Mustards	Nightshades	Velvetleaf
Dual Magnum	P	F	P	G	F	E	P	G	P
Ro-Neet	F	G	P	G	P	P	P	G	P
Spinaid	E	E	E	P	G	F	F	F	F
Stinger	P	P	E	P	G	E	P	E	P

Notes: E = excellent; G = good; F = fair; P = poor to no control

Adapted from MSUE Extension Bulletin E-433 and Cornell ICWM Guidelines for Commercial Vegetable Production

Table 2. Efficacy of carrot herbicides on selected annual broadleaf weeds

Product	Lambsquarters	Purslane	Ragweed	Pigweed	Smartweed	Galinsoga	Mustards	Nightshades	Velvetleaf
Dual Magnum	P	F	P	F	F	E	P	G	P
Lorox	E	E	G	E**	G	E	E	P	G
Prowl H2O	G	G	P	F	F	P	F	P	G
Treflan	F	F	P	G	P	P	P	P	P
metribuzin	E	E	E	G	E	E	E	P	G

Notes: E = excellent; G = good; F = fair; P = poor (but results will vary!)

**Lorox resistant Powell amaranth is present in some areas

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In some cases, weeds produce seeds in surprisingly large numbers in rotational crops that can be very costly in subsequent vegetable crops. For example, “daisy” (=corn chamomile =*Anthemis arvensis*) often does well in winter wheat, producing large numbers of long-lived seeds (Figure 2). Although it does not impact wheat yields very much, producers trying to grow processing peas after wheat in a rotation can run into problems. In this case, more intensive weed management in wheat is likely a wise investment to prevent the trouble and expense with managing this weed in a subsequent pea crop. As with any crop in which weeds have escaped management, it is often worthwhile to mow, disk or spray soon after harvest to help minimize weed seed production.



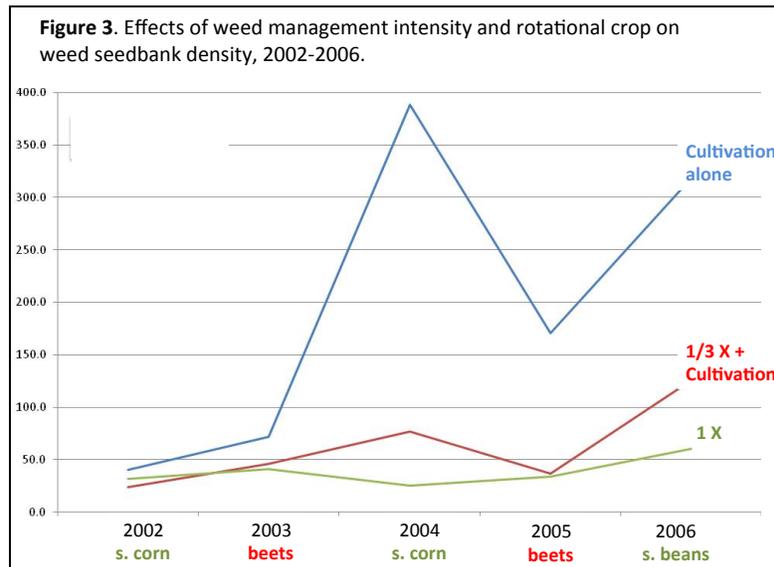
Figure 2. Corn chamomile (black seed heads) can produce lots of seeds in wheat and become a problem in subsequent vegetable crops.

Weed seed production in cover crops. Although cover crops are a valuable tool for protecting and improving soils, poorly established cover crops often fail to adequately suppress weeds, resulting in production of large numbers of seeds. For example, in one study we evaluated seed production of weed species growing below a sorghum-sudangrass cover crop sown following early harvested vegetables. Although the sorghum-sudangrass produced 5 t/A of biomass, *Galinsoga ciliata* and purslane growing below the sorghum-sudangrass canopy produced over 100 seeds/ft². The situation in other cover crops can be far worse. For example, in trials examining cowpea as a summer cover crop, pigweed (Powell amaranth) growing with cowpea produced over 10,000 seeds/ft²! To avoid such weed seed production it may be worthwhile to terminate cover crops before weeds have gone to seed. Of course, choosing the appropriate cover crop for the available planting window, and using a grain drill to help insure uniform establishment can go a long way towards avoiding this problem. Use of higher than typically recommended seeding rates can also greatly reduce the risk of weed seed production.

Cover crops for weed suppression. When cover crops are well chosen and managed they can reduce weed populations by preventing seed production or by encouraging predation and decay of species of some weed seeds. For example, in one long-term study, a rotation involving winter wheat without cover crops was compared to a rotation with red-clover frost-seeded into winter wheat. In the final year, cabbage, sweet corn and snap beans were grown under three levels of weed management. After 3 years, the wheat-red clover rotation had far fewer weed seeds than wheat alone and reduced weed pressure in subsequent processing vegetable crops. Evidence from other studies suggests that the observed reduction of seeds under red clover may be partly due to suppression of weed seed production after wheat harvest, and partly due to higher levels of seed predators (e.g. crickets, carabid beetles) where red clover is present.

Crop rotation effects on weed seedbanks. Several long-term studies have been conducted looking at the impact of different crop rotations and weed management strategies on weed communities in processing vegetables. In one trial, the cumulative effects of crop rotation and weed management intensity (cultivation only; banded herbicides+ cultivation; and full rate herbicides) on rotations involving snap beans, beets, sweet corn, potatoes and cabbage were

examined. After 5 years, rotations involving cultivation alone had roughly 3-5 times as many weeds in the soil than those involving full rates of herbicides (Figure 3). Weed seeds in the soil following years with weak competitors like beets were higher than years with stronger competitors like sweet corn (Figure 3) or potatoes. “Cleaning crops” like potatoes can play an important role in reducing weed seedbanks and lowering weed management costs in processing vegetables.



Tillage effects on weed seedbanks. Another major factor influencing weed seedbanks is tillage. As growers move towards reduced tillage practices, there is often a shift towards more perennial and winter annual species. With less tillage to sever, uproot, or bury these weeds they often gain ground. Tillage also changes the vertical distribution of seeds in the weed seedbank which changes the selective forces influencing weed communities. For example, under reduced tillage systems, more weed seeds are left on the soil surface. Since small seeds generally have an advantage relative to large seeds on the soil surface, there is often a shift towards smaller seeded species under reduced tillage. Many grass weeds, which are effectively killed when buried by tillage, also become more problematic when tillage is avoided. In reduced tillage trials in SW Michigan we have seen increased prevalence of large crabgrass, winter annuals and perennials after three years. Although reduced tillage can have many beneficial effects on soil quality, care must be taken to avoid the buildup of such weeds.